REMARKS

Claim Objections

Claim 23 has been amended as noted by the Examiner to correct the error in dependency.

Claim Rejections 35 U.S.C. § 102

Claims 1-9 and 12-30 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Danielsen. In light of this rejection, independent claims 1 and 17 have been amended and independent claim 15 has been cancelled.

Danielsen shows a pair of processors executing an identical program and receiving identical inputs. The processors compare their outputs at the conclusion of execution, which is presumably cyclic, to detect an error in the execution of one of the processors. The system of Danielsen is intended for use in an anti-lock braking system (ABS) and, thus, like the present invention, is executing a form of real-time control.

Nevertheless, in contrast to the present invention, the Danielsen system appears to be monitoring a single, slowly changing variable (wheel speed) to deduce slippage. Because the change in this variable is much slower than the execution speed of the processor, each processor may independently receive and process the input data, as depicted in Figure 7 of Danielsen, with an expectation that the inputs and computed outputs will match.

In contrast, the present invention contemplates a safety system having possibly hundreds of inputs, each which may change asynchronously to collectively define a state that can change extremely rapidly. In this environment it is unlikely that the two processors, separated from the I/O and each other by a network, would have exactly the same set of input data, at any point in the execution cycle, or produce the same output data. For this reason, the present invention forces identical inputs onto each processor by a buffering process in which one buffered copy of the input variables is collected and shared with the two processors before execution begins. See generally paragraph [0076] of the present application.

The present claim 1 has been amended to capture this distinction. As a result, Danielsen does not teach "a buffer receiving a plurality of independent variables, asynchronously from I/O circuits connected to sensors" or a "coordination program," providing each of the first and second processing units with "copies of the input variables at a predetermined point in the execution cycle" as now expressly claimed.

It is believed that a person of ordinary skill in the art reviewing Danielsen would logically be led to the solution described in paragraph [0006] of the present application, that is, dealing with the large number of asynchronous variables by making a comparison at each instruction by cross-checking input values and output values on an instruction-by-instruction basis as is done in the prior art. This solution would further be suggested because of the perceived need in safety industrial control to perform more detailed cross-checking than is obtained by simple output comparison.

This distinction underlies a second feature of the present invention embodied in independent claim 16, which is: the present invention provides not only a comparison of output values but also a comparison of intermediate values that are not output. This comparison is performed on a less frequent basis that the comparison of output values allowing a tradeoff between sensitivity in detecting errors and speed of execution. This comparison of intermediate values is not taught in Danielsen, which only teaches the comparison of output values.

While the Examiner has noted that Danielsen teaches a comparison of values of internal variables, at col. 4, lines 23-41, this, in fact, describes the generation of key values which are used solely for the purpose of identifying the correct operation of the processors and are not intermediate values leading to the determination of output values as required by the present invention. Further, these key values of Danielsen are not compared to each other (as required by the claim 1) but stand independently to identify an error in one of the processors. Further, there is no indication that there are two rates of comparison undertaken in Danielsen.

The method claim 17 corresponding to claim 1 has been amended in a manner similar to that of claim 1 and is believed to be allowable for the same reasons as described above with respect to claim 1.

In light of these remarks and amendments, it is believed that claims 1-8, 10-11, 13-14, and 16-28 are now in condition for allowance and allowance is respectfully requested.

Very truly yours,

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